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Office of Legacy Management

Environmental Monitoring Program at Site A and Plot M, Palos Forest Preserve, Cook County, Illinois

February 2004

U.S. Department of Energy

Work Performed Under DOE Contract No. DE–AC01–02GJ79491 for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.
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Contents

Figures

Tables

1.0 Introduction

As part of the transfer of Site A and Plot M to the U.S. Department of Energy Office of Legacy Management (DOE−LM) at Grand Junction, Colorado, for long-term stewardship, a periodic re-evaluation of existing monitoring plans was undertaken (DOE 2003).

The technical evaluation consisted of a qualitative review of the most recent Argonne National Laboratory (ANL) annual environmental monitoring report (ANL 2002) and similar reports for the past 10 years. Initial assessment of the program indicated that monitoring had demonstrated that the site was behaving as predicted and there was no unacceptable risk to human health and the environment. In the context of long-term stewardship activities at other DOE sites, it appeared that the monitoring program could be modified at this time without compromising the DOE objectives to observe areas where potential problems or exposures may exist and ensure ongoing protection of human health and the environment.

The technical evaluation was developed with a group consisting of the staff and contractors representing ANL, the DOE Chicago Operations Office (DOE−CH), and the Illinois Emergency Management Agency (IEMA). This report presents the consensus of the group for a revised environmental monitoring program to be implemented at Site A and Plot M effective in February 2004. This report will also serve as the interim sampling and analysis plan until it is incorporated into a revision of the Long-Term Surveillance Plan (LTSP) for Site A and Plot M (DOE 1999).

2.0 Site Conditions

2.1 Site History

Ground water and surface water in the vicinity of Site A and Plot M in the Palos Forest Preserve, near Chicago, Illinois (Figure 1) were contaminated as a result of research operations at Site A (former site of ANL and its predecessor, the University of Chicago Metallurgical Laboratory) from 1943 through 1954 involving reactor physics studies, fission product separations, hydrogen-3 recovery from irradiated lithium, and work related to the metabolism of radionuclides in laboratory animals. During, and at the termination of the programs, radioactive waste and radioactively-contaminated laboratory articles from these studies were buried at Plot M, reactor fuel and heavy water were removed from the site, and the biological shield for the CP-3 reactor at Site A was buried in place. In 1956, the U.S. Atomic Energy Commission (AEC) placed a concrete cap over Plot M.

2.2 Hydrogeology

Site A and Plot M are located on rolling glacial terrain with poorly developed drainage. The area is underlain by glacial till or drift that is generally fine-grained (silty clay) and impermeable, with discontinuous lenses of coarse material (sandy silt and gravel) that may contain perched water. The glacial drift, ranging in thickness from 0 to 165 feet, is underlain by Silurian dolomite

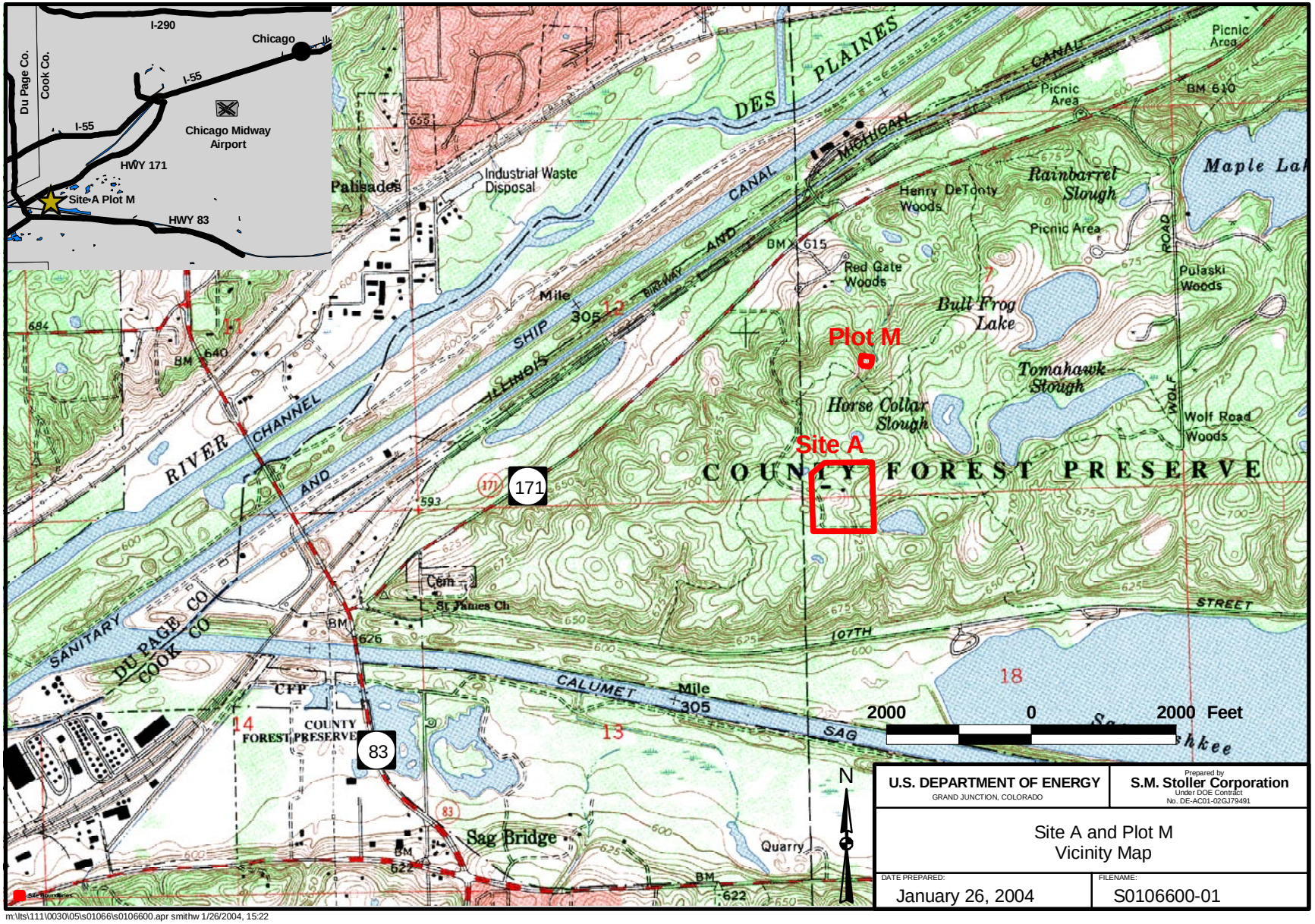

Figure 1. Vicinity Map, Site A and Plot M, Palos Forest Preserve, Illinois

that is approximately 200 feet thick. Ground water occurs in the dolomite aquifer under unconfined conditions. The dolomite aquifer was previously a source of drinking water (withdrawn using hand-pumped wells) in the adjacent Red Gate Woods picnic area of the forest preserve. Water is no longer available for public use because of high fecal coliform levels.

A detailed investigation of the hydrogeologic and geochemical properties of the glacial drift was conducted by the U.S. Geological Survey (USGS) to determine the extent of hydrogen-3 in the glacial drift and the rate and direction of movement in ground water in bedrock (USGS 1984). These studies showed that anisotropic geologic and hydraulic properties of the drift significantly affected ground water flow and contaminant migration. The size, shape, and configuration indicate that the plume is a single slug and that the site no longer releases hydrogen-3 into the glacial drift. The leading edge (or front) of the plume probably left the burial site in the late 1940s or early 1950s and intersected the underlying bedrock surface before 1973. Several key factors that control both the activity level and the extent of migration of hydrogen-3 in ground water in the glacial drift at Plot M are: (1) the limited amount of tritiated waste buried at Plot M, (2) the long period of time that has elapsed since the waste was buried relative to the radioactive half-life of hydrogen-3 (approximately 12.3 years), and (3) the great thickness and low permeability of the glacial drift at the site.

2.3 Water Quality

The primary constituents of concern in ground water and surface water in the vicinity of Site A and Plot M are hydrogen-3 (tritium) and strontium-90. Radiological characterization of Site A and Plot M showed that very low levels of hydrogen-3 migrated from the burial ground at Plot M and were observed in two nearby hand-pumped picnic wells in the Red Gate Woods area approximately 1,500 feet to the north. Hydrogen-3 activity is still detected in the picnic wells, but average and maximum activities are significantly less than previous observations and well below the Illinois state drinking water standard of 20,000 picoCuries per liter (pCi/L) [equivalent to 20 nanoCuries per liter (nCi/L)]. Hydrogen-3 continues to be detected in a number of monitor wells at the sites and a surface stream in the vicinity of Plot M. Low levels of strontium-90 have been observed in ground water from a number of monitor wells near Site A and Plot M since 1984. The Illinois state drinking water standard for strontium-90, 8 pCi/L, was slightly exceeded at one location in the glacial till at Site A in 2002 (9.17 pCi/L).

2.4 Risk

Activities of hydrogen-3 and strontium-90 have been detected in well water in the vicinity of Site A and Plot M though the vast majority of samples have been well below the Illinois state drinking water standards of 20 nCi/L and 8 pCi/L, respectively (EPA 1999). At one time, picnic wells at the Red Gate Woods were used as a source of drinking water for visitors to the picnic grounds. These wells are no longer used, and the only complete route of exposure to ground water is where the water surfaces at a local seep and intermittent surface stream. Because actual exposures to contaminated ground water and surface water are relatively low, it can be concluded that actual risks posed by site-related contamination are negligible to nonexistent. Potential risks continue to decrease as activities of constituents in the ground water system continue to decline. Results of the surveillance program continue to indicate that while radioactivity remains in the subsurface in the vicinity of Site A and Plot M and at the surface seep at Plot M, the potential for release of hazardous amounts of contamination into ground

water and surface water is low and the observed levels of contamination do not endanger the health or safety of the public visiting the site, using the picnic area, or living in the vicinity. Potential radiation doses are well below the relevant standards.

The Illinois Department of Public Health (IDPH) conducted recent public health assessments of Site A and Plot M (IDPH 2002a and 2002b). The IDPH came to the conclusion that cleanup at Site A has been adequate to protect the public from any risks that the site may have posed in the past. IDPH also concluded that under current conditions, exposures at Plot M are not at levels that would be expected to cause adverse health effects, and therefore the site does not pose a public health hazard. Based on infrequent exposures that would be likely to occur at the sites today, and the fact that contaminated materials are buried at depth, the sites were determined to currently not pose any unacceptable risks.

3.0 Environmental Monitoring

3.1 Monitoring Program

Based on discussions and consensus of the group, including DOE−LM, DOE−CH, ANL, and IEMA, the following path forward for revision and implementation of the environmental monitoring program for Site A and Plot M is recommended:

- Adopt the monitoring program defined in Table 1 and Figure 2. This consists of 32 locations sampled on a quarterly basis, with 144 analyses for hydrogen-3 and 30 analyses for strontium-90.
- The monitoring program will be carried out by ANL personnel as in the past. The sampling crew will also make observations of the sites while performing the quarterly water sampling, which will be part of the overall surveillance for security and maintenance of the sites.
- Analytical data will be shared among participants. DOE−LM maintains a database for reference and presentation to stakeholders.
- Reporting and distribution of information to stakeholders will be performed in the method standardized under the DOE−LM long-term surveillance and maintenance program. Information will be presented in annual reports and will be available on the DOE−LM website (www.gjo.doe.gov).

Justification for the sampling locations is based on technical and stakeholder concerns. The distribution of locations will ensure that conditions will be known to remain protective. The quarterly frequency is based on variable weather and the seasonal response in the hydrogeologic system. Also the inherent complexity of the hydrogeologic system will be more closely monitored with this frequency. Analyses are restricted to the main constituents of concern which are hydrogen-3 and strontium-90. Analyses of metals are no longer needed since it has been determined that they are not related to potential source materials.

DOE will evaluate this monitoring program every three to five years. Changes should be implemented in the program, as deemed necessary, and with input from the stakeholders, to maintain the DOE mission of protection of human health and the environment, and reasonably reflect conditions at the sites and the level of potential risk.

Table 1. Summary of Sampling and Analysis Plan for Site A and Plot M, Palos Forest Preserve, Illinois

Area	Number	Frequency and Analytes	Location
Ground Water from Monitor Wells in Glacial Drift			
Plot M	BH2	4X H/S	Downgradient from Plot M
	BH3	4X H/S	Downgradient from Plot M
	BH4	4X H/S	Downgradient from Plot M
	BH6	4X H/S	Cross gradient from Plot M
	BH9	4X H/S	Slant hole beneath Plot M
	BH10	4X H/S	Slant hole beneath Plot M
	BH11s	4X H/S	Downgradient from Plot M
	BH26	4X H/S	Downgradient from Plot M
	BH35	4X H/S	Farther downgradient from Plot M
Site A	BH41	4X H/S	Offsite --downgradient to west
	BH51	4X H/S	Onsite -- south
	BH52	4X H/S	Offsite -- east
	BH54	4X H/S	Onsite -- north
	BH55	4X H/S	Onsite -- middle
	BH56	4X H/S	Onsite -- middle
Ground Water from Monitor Wells in Dolomite			
Plot M	DH3	4X H	Downgradient from Plot M
	DH4	4X H	Farther downgradient from Plot M
	DH9	4X H	Downgradient from Plot M and adjacent to picnic wells
	DH10	4X H	Downgradient from Plot M and adjacent to picnic wells
	DH11	4X H	Downgradient from Plot M and adjacent to picnic wells
	DH12	4X H	Downgradient from Plot M and adjacent to picnic wells
	DH13	4X H	Downgradient from Plot M and adjacent to picnic wells
	DH14	4X H	Downgradient from Plot M and adjacent to picnic wells
	DH15	4X H	Downgradient from Plot M and adjacent to picnic wells
	DH17	4X H	Downgradient from Plot M and adjacent to picnic wells
Ground Water from Picnic Wells in Dolomite			
	5159	4X H	Recently used picnic well -- may be used for drinking in future
	5160	4X H	Recently used picnic well -- may be used for drinking in future
Surface Water and Seep			
Plot M	0001	4X H	Upstream from Plot M
	0006	4X H	Seep -- adjacent to Plot M
	0007	4X H	Downstream from Plot M
	0008	4X H	Downstream from Plot M
Regional	Ponds - 5	4X H	Adjacent ponds in vicinity of Plot M

Key:
4X = frequency per year at location
H = hydrogen-3 or tritium
S = strontium-90

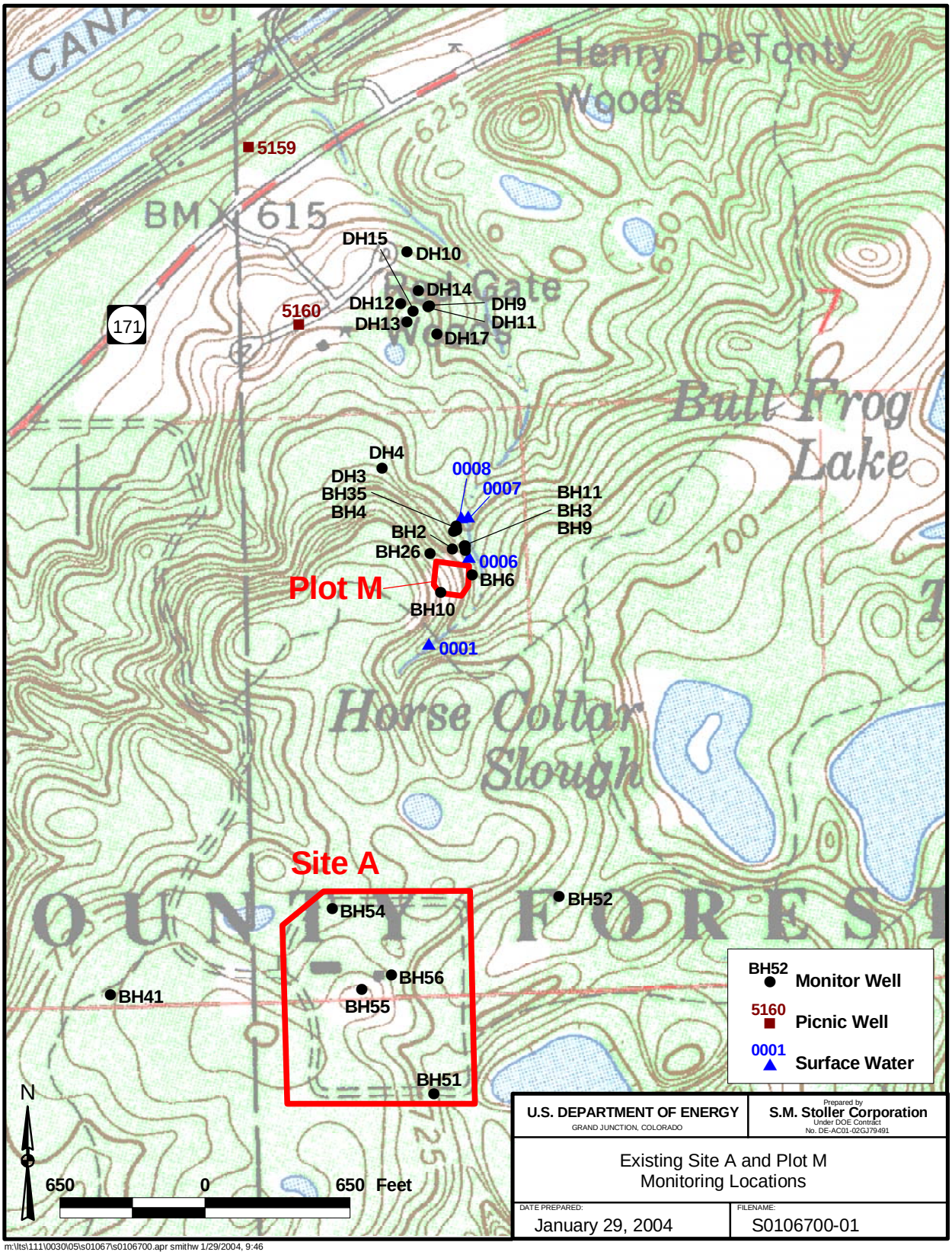

Figure 2. Monitoring Locations at Site A and Plot M, Palos Forest Preserve, Illinois

3.2 Quality Assurance

The long-term custody of Site A and Plot M and all activities related to surveillance, monitoring, and maintenance of the site will comply with relevant DOE quality assurance requirements.

3.3 Records and Reporting

The monitoring program will be managed by DOE ANL contractors. Samples will be collected by ANL personnel in accordance with the *Sampling and Analysis Plan for GJO Projects* (DOE 2002) and an approved QA program implemented for LM environmental monitoring activities.

Reporting will be done in the current format for this type of site and distributed to appropriate stakeholders. The annual report and monitoring results will be available on the DOE−LM website (www.gjo.doe.gov).

All DOE−LM Program records are maintained in full compliance with DOE requirements.

3.4 Health and Safety

All site activities are conducted in accordance with health and safety procedures established for DOE−LM. These procedures are consistent with DOE orders, regulations, codes, and standards.

Maintenance subcontractors are advised of health and safety requirements through appropriate procurement documents. Subcontractors must submit health and safety plans for all activities subject to Occupational Safety and Health Administration (OSHA) requirements. Subcontractor health and safety plans are reviewed and approved before contracts are awarded.

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